

II. Remarks

The Official Action of August 20, 2010 has been thoroughly studied. Accordingly the changes presented herein for the application, considered together with the following remarks are believed to be sufficient to place the application into condition for allowance.

By the present amendment independent claim 1 has been changed to recite that the acrylic elastomer composition comprises a carboxylic group-containing acrylic elastomer consisting of a copolymer of at least one of an alkyl acrylate having an alkyl group of 1-8 carbon atoms and an alkoxyalkylacrylate having an alkoxyalkyl group of 2-8 carbon atoms with a carboxyl group-containing unsaturated compound.

Support for this limitation can be found paragraph [0008] of applicants' original specification.

Also by the present amendment, dependent claim 5 has been changed to recite that an amine-based or phenol-based antioxidant is further used together with the thiazole-based compound.

Support for this limitation can be found in paragraph [0016] of applicants' original specification.

As argued below, applicants' previously pending claims are allowable over the prior art absent the present amendments. The present amendments further distinguish the present invention over the prior art and should be entered in view of the comments below.

Entry of the changes to the claims is therefore respectfully requested.

Claims 1, 5, 8, 10, 12 and 14-16 are pending in this application.

Claims 1, 5, 8, 10 and 12 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,157,083 to Aonuma et al.

Claims 14-16 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Aonuma et al. in view of U.S. Patent No. 6,156,849 to Moriyama et al.

For the reasons set forth below, it is submitted that each of the pending claims are allowable over the prior art of record and therefore, the outstanding rejection of the claims should properly be withdrawn.

Favorable reconsideration by the Examiner is earnestly solicited.

The Examiner has relied upon Aonuma et al. as disclosing:

...a rubber composition comprising a polymer obtained by adding maleic anhydride or a derivative thereof (abstract) which reads on acrylic elastomer of instant claims. The maleic anhydride derivative used include maleic acid monoalkyl esters such as monomethyl maleate (col. 2, lines 51-55) which reads on aliphatic unsaturated dicarboxylic acid monoalkyl ester. The composition is obtained by adding vulcanizing agents and antioxidants (col. 3, lines 16-18). See table 2, wherein vulcanization occurs in two stages (i.e. primary vulcanization and secondary vulcanization) under heating conditions, and the amount of modified rubber used is 100 parts by weight. The vulcanizate obtained can be used for producing various articles (col. 5, lines 3-20) which reads on article of instant claim 8.

The Examiner concedes that: "Aonuma et al. are silent with respect to press vulcanization and secondary oven vulcanization."

The Examiner has accordingly relied upon Moriyama et al as teaching:

...acrylic elastomer comprising fumaric acid mono-lower alkyl ester. It is noted that fumaric acid mono-lower ester is an isomer of maleic anhydride derivative disclosed in Aonuma et al. The composition comprises diamine compound, vulcanization promoters and can be vulcanization molded into seal members (abstract). The composition is subjected to press vulcanization and then to secondary vulcanization in an oven (col. 6, lines 26-29).

In combining the teachings of Aonuma et al. and Moriyama et al. the Examiner has taken the position that:

...it would have been obvious to subject the rubber composition of Aonuma et al. to press vulcanization because Aonuma discloses that the rubber composition if vulcanized in two stages and Moriyama has shown successfully that elastomeric compositions comprising acrylic elastomer, prepared from an isomer of maleic

anhydride derivative disclosed in Aonuma et al can be subjected to press vulcanization followed by oven vulcanization.

Aonuma et al. discloses a rubber composition comprising a polymer that is obtained by adding maleic anhydride or a derivative thereof to a nitrile-group-containing highly saturated polymer rubber as stated in the abstract.

Aonuma et al. relates to maleic anhydride (derivative)-modified, hydrogenated NBR.

In contrast, the present invention relates to a carboxylic group-containing acrylic rubber.

Even though the maleic anhydride (derivative)-modified, hydrogenated NBR of Aonuma et al. and the carboxylic group-containing acrylic rubber of the present invention are similar in regards to the carboxylic group-containing component, the base polymers of these two are completely different.

Vulcanization of maleic anhydride (derivatives)-modified hydrogenated NBR is carried out by peroxide crosslinking or sulfur vulcanization. In the case of sulfur vulcanization, there is a description that 2-mercaptobenzothiazole (Zn or Ni salt) can be used as a vulcanizing accelerator (or promoter) (column 3, lines 40-54); however there are no examples where in sulfur vulcanization is carried out.

In contrast, in the present invention only a polyvalent amine compound is used as a vulcanizing agent. Polyvalent amines compounds, and applicants' preferred p-substituted aromatic diamines, are not disclosed as vulcanizing agents in Aonuma et al.

In response to the above argument, on page 5 of the Office Action the Examiner has stated:

...that transitional phrase "comprising" is inclusive or open-ended and does not exclude additional, unrecited elements. Hence, it is the examiner's position that instant claims are open to addition of other components.

The Examiner's comment seems to infer that applicants' previous claims allowed for other components, such as the mercaptobenzothiazole, mercaptothiazole and the like of Aonuma et al. that are used as a vulcanizing accelerator together with a sulfur and/or sulfur donating compound. This inference comes from the Examiner reference to "(C) and (F)" on page 4 line 11 prior to the above quoted statement.

Applicants' independent claim 1, prior to the present amendment, recites "a vulcanizing agent consisting of polyvalent amine compound."

Notwithstanding the Examiner's position that applicants' acrylic elastomer is required to have (in addition to other components) a vulcanizing agent that consists of a polyvalent amine compound.

It does not appear that the prior art teaches this claim limitation.

In order to more clearly define over the prior art, independent claim 1 has been amended herein to recite that the acrylic elastomer composition comprises a carboxylic group-containing acrylic elastomer consisting of a copolymer of at least one of an alkyl acrylate having an alkyl group of 1-8 carbon atoms and an alkoxyalkylacrylate having an alkoxyalkyl group of 2-8 carbon atoms with a carboxyl group-containing unsaturated compound.

On page 4 of the Office Action the Examiner states that:

Aonuma et al teach an acrylic elastomer composition comprising maleic anhydride copolymerized with NBR and meets the instant claim limitation.

Such an acrylic elastomer composition is not encompassed by applicants' independent claim 1.

Therefore the Examiner's reliance upon Aonuma et al. as teaching an acrylic elastomer composition comprising maleic anhydride copolymerized with NBR is of no avail in regards to applicants' claimed invention.

Further the Examiner's reliance upon Aonuma et al. as teaching "sulfur based compounds as vulcanizing agents" is no longer germane because sulfur based vulcanizing agents are not encompassed by applicants' independent claim 1.

On page 4 of the Office Action the Examiner states:

while examples in instant application use "di-o-tolylguanidine vulcanization promoter" as a vulcanization promoter, Aonuma refers to the sulfur based compounds as vulcanizing agents.

It seems as through the Examiner may infer that di-o-tolylguanidine is a sulfur based compound; however, this is not the case.

On page 5 of the Office Action the Examiner states that:

applicant's argument that N-substituted antiozonant, of Aonuma et al. has no "crosslinking" function, and aliphatic unsaturated dicarboxylic acid monoalkyl ester-copolymerized acrylic elastomer does not cause sulfur vulcanization, is a conclusory statement which is not supported by evidence i.e. attorney's statements are not a substitute for factual evidence.

In order to prove that the N-substituted antioxidants of Aonuma et al. have no cross-linking function the following comparative experiments were conducted.

In place of 1 parts by weight (pbw) of 4,4'-diaminodiphenyl ether, which is a vulcanizing agent of polyvalent amine compound, in the acrylic elastomer used in Example 2 in the present specification, 2 pbw (Experiment 1) or 5 pbw (Experiment 2) of N-phenyl-N'-isopropyl-p-phenylenediamine, which is described in column 4, lines 11-12 in Aonuma et al. and 2 pbw (Experiment 3) or 5 pbw (Experiment 4) of N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine, which is described in column 4, lines 13-14, were used. In these Examples the following items were determined to compare vulcanizing characteristics:

Mooney viscosity and scorch (125°C):

- values of ML_{1+4} , ML_{min} and t_5 were determined according to JIS K-6300

Rheometer curing properties (180°C/12min):

- values of ML and MH were determined according to JIS K6300

The results of these Examples are shown in the following Table together with Formulation (pbw). In the Examples ethyl acrylate/butyl acrylate/2-methoxy ethyl acrylate/mono-n-butyl fumarate (charged comonomer molar ratio 10/48/40/2) copolymer used in Examples and Comparative Examples in the present specification were used as the acrylic rubber.

Table

| Formulation | Experiment | | | | |
|---|------------|-----|-----|-----|-----|
| | EX. 2 | 1 | 2 | 3 | 4 |
| Acrylic rubber | 100 | 100 | 100 | 100 | 100 |
| FEF carbon black | 55 | 55 | 55 | 55 | 55 |
| Stearic acid | 1 | 1 | 1 | 1 | 1 |
| 4,4'-bis(α,α' -dimethylbenzyl)-diphenylamine | 2 | 2 | 2 | 2 | 2 |
| Phosphoric acid ester-based processing aid | 1 | 1 | 1 | 1 | 1 |
| 4,4'-diaminodiphenyl ether | 1 | | | | |
| 1,3-di-o-tolyguanidine | 2 | 2 | 2 | 2 | 2 |
| 2-mercaptobenzothiazole | 1 | 1 | 1 | 1 | 1 |
| N-phenyl-N'-isopropyl-p-phenylenediamine | | 2 | 5 | | |
| N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine | | | | 2 | 5 |
| Item of Determination | | | | | |
| Mooney viscosity and scorch | | | | | |
| ML ₁₊₄ (pts) | 29 | 29 | 26 | 29 | 26 |

| | | | | | | |
|-----------------------------|-------|------|------|------|------|------|
| ML _{min} | (pts) | 29 | 29 | 26 | 29 | 26 |
| t ₅ | (min) | 6.5 | NG | NG | NG | NG |
| Rheometer curing properties | | | | | | |
| ML | (N·m) | 0.12 | 0.12 | 0.12 | 0.12 | 0.11 |
| ML | (N·m) | 0.52 | 0.12 | 0.11 | 0.12 | 0.11 |

(NG indicates that no data was obtained due to no crosslinking)

From the MH values of the Rheometer curing properties (180°C/12min), it can be seen that no crosslinking occurred when two kinds of N-substituted antioxidants described in Aonuma et al. were used in place of the 4,4'-diaminodiphenyl ether, which is a crosslinking agent. Further, no increase of vulcanizing torque was determined thus finding that no crosslinkage occurred even when the compositions were subjected to press vulcanization at 180°C for 12 minutes.

Further the values of ML_{min} and t₅ in Ex. 2 are a bit different from that obtained in Example 2 in the present specification; however, these are within the scattering of experimental error. However, regarding the date of ML_{min}, no vulcanizing reaction occurred in Experiments 1-4. The vulcanizing torque will reach a minimum value within a few minutes when it is measured and stay constant. The measured data of ML_{min} becomes that of ML₁₊₄.

From the above it can be established that the N-substituted antioxidants of Aonuma et al. have no cross-linking function.

Thus it is submitted that in Aonuma et al. the N-phenyl-N'-isopropyl-p-phenylenediamine is used as an antiozonant. However, N-substituted diamine compounds act as antiaging agents such as antiozonants, etc. and therefore, it is a well known fact that this kind of N-substituted compound has no "crosslinking" function as demonstrated above.

Thus Aonuma et al. does not teach applicants' polyvalent amine vulcanizing agents.

Based upon the above distinctions between the prior art relied upon by the Examiner and the present invention, and the overall teachings of prior art, properly considered as a whole, it is respectfully submitted that the Examiner cannot rely upon the prior art as required under 35 U.S.C. §103 to establish a *prima facie* case of obviousness of applicants' claimed invention.

It is, therefore, submitted that any reliance upon prior art would be improper inasmuch as the prior art does not remotely anticipate, teach, suggest or render obvious the present invention.

It is submitted that the claims, as now amended, and the discussion contained herein clearly show that the claimed invention is novel and neither anticipated nor obvious over the teachings of the prior art and the outstanding rejection of the claims should hence be withdrawn.

Therefore, reconsideration and withdrawal of the outstanding rejection of the claims and an early allowance of the claims is believed to be in order.

Conclusion

It is believed that the above represents a complete response to the Official Action and reconsideration is requested.

If upon consideration of the above, the Examiner should feel that there remain outstanding issues in the present application that could be resolved; the Examiner is invited to contact applicants' patent counsel at the telephone number given below to discuss such issues.

To the extent necessary, a petition for an extension of time under 37 CFR §1.136 is hereby made. Please charge the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 23-1925 and please credit any excess fees to such deposit account.

Respectfully submitted,

Dated: November 22, 2010

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